

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. : 09/945,123
Appellant : LEYDIER, Robert A.
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Examiner : JACKSON, Jenise E.
Docket No. : 40.0048
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Commissioner for Patents
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APPELLANT'S BRIEF

1. Real Party in Interest

The real party in interest in this appeal is Gemalto N.V., a corporation of the Netherlands. The application is formally assigned to Axalto, Inc. Axalto, Inc. is the U.S. subsidiary of Gemalto.

2. Related Appeals and Interferences

There are no related appeals and interferences.

3. Status of Claims

Claims 1-48 are pending in the application. Claims 1-15, 27-38, 43 and 44 were rejected and Claims 16-26, 39-42, and 45-48 were objected to in the Office Action of 12/08/2005. Claims 16-26, 39-42 and 45-48 stand as allowable if rewritten in independent form and incorporating the limitations of base and intervening claims.

4. Status of Amendments

No amendments have been made since the Office Action of 12/08/2005. All amendments have been entered.

5. Summary of Invention

The invention is directed to an integrated circuit card, e.g., a smart card, with an integrated biometric voice sensor and a voice processing circuitry operable to receive a signal from the biometric voice sensor to process the signal to extract signal characteristics. The signal characteristics may be indicative of a user's voice characteristics and may be used to authenticate the user. Alternatively, the voice characteristics may be verified against information indicative of a user speaking a password.

It should be noted that both the biometric sensor and mechanisms to store information used to authenticate a user are integrated into the integrated circuit card. This significantly improves the security associated with the use of integrated circuit cards. Traditionally, users of smart cards are authenticated by the user entering a personal identification number (PIN) on a keypad. A characteristic of smart cards is that

smart cards do not have their own input and output devices but use the i/o devices of computers or terminals to which they are connected. While there are many ways to connect a keypad to a smart card, in the prior art the PIN always has to be communicated to the smart card. More recently, biometric devices, e.g., thumb print readers or retina scans, have been employed for authentication. However, the readers for this information also have been deployed outside of the smart card. Therefore, also for authentication with biometric sensors, the authenticating information was required to be communicated between a reader or sensor and the smart card.

Any time that information is communicated between two devices there are security risks. There is an additional opportunity to replace the input device with a device that logs entries, e.g., keyboard logging, thereby being able to save a PIN for future unauthorized use, or to replace the input device with a device that mimics the biometric information of the legitimate owner. Furthermore, there is the opportunity to snoop on the data channel, thereby misappropriating the authenticating input information, whether a PIN or some biometric data.

Before the appellant's invention, there was no integrated circuit card with an input device for PIN or biometric data. By placing an integrated voice sensor on the integrated circuit card and having the processing modules on the same card, the aforementioned security issues are avoided.

6. Grounds for Rejection to be Reviewed on Appeal

1. 35 USC 102(b)

Claims 1-14 and 28-37, 43 are rejected under 35 USC 102(b) as being anticipated by Kennedy et al (6,084,967, hereinafter Kennedy).

2. 35 USC 103(a)

Claims 15, 27, 38 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kennedy in view of Maes et al. (6,411,933, hereinafter Maes).

7. Argument

1. 35 USC 102(b)

Claims 1-14 and 28-37, 43 are rejected under 35 USC 102(b) as being anticipated by Kennedy. Appellants respectfully request reversal of the rejection and allowance of the claim.

A brief summary of Kennedy may help the Board in understanding that Kennedy is a prime example of the prior art in which the biometric sensing technology is located outside of the smart card and is therefore prone to the security issues associated with such solutions. Kennedy discloses a radiotelephone 101 which has an opening into which may receive a smart card (Kennedy, Col. 2, lines 30-32). The smart card stores “feature vectors” of users voice. (Kennedy, Col. 2, lines 56-57). When the smart card is inserted into the telephone, the user is prompted to state a particular sound pattern such as the user’s name (Kennedy, Col. 2., lines 58-60). The telephone compares the speech with the feature vectors.

The radiotelephone contains biometric verification circuitry that works in cooperation with the smart card (Col. 3, lines 7-8). The speech is converted into digital speech signals by conventional circuitry in the radiotelephone (Col. 3, lines 14-16). Thus, it should be clear that in Kennedy the smart card only contains the “feature vectors” and all other parts of the biometric technology, i.e., the voice sensor and biometric verification circuitry, are outside of the integrated circuit of the smart card. Furthermore, Appellants respectfully suggest that the Board may take judicial notice of that because Kennedy’s invention is deployed as part of a radiotelephone the voice sensor of Kennedy, absent disclosure to the contrary, is the microphone conventionally found in such devices and not part of an integrated circuit.

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. The identical invention must be shown in as much detail as is contained in the claim.” MPEP 2131. That standard cannot be met using the Kennedy reference.

Claim 1 recites:

“an integrated circuit having a biometric voice sensor integrated into a portion of the integrated circuit, wherein the voice sensor is configured to detect the speech of a user and to produce a signal responsive to the speech of the user; and
a voice processing circuit integrated into a portion of the integrated circuit, wherein the voice processing circuit is configured to receive the signal from the biometric voice sensor and to process the signal to extract the signal characteristics.”

Kennedy does not teach or suggest these elements.

Claim 1 recites “an integrated circuit having a biometric voice sensor integrated into a portion of the integrated circuit.” Kennedy does not teach or suggest that element.

On the contrary Kennedy states that “the radiotelephone 101 includes biometric verification circuitry 201 which works in cooperation with the token or smart card 105” (Kennedy, Col. 3, lines 6-8).

The Examiner has made the assertion that “a biometric voice sensor is inherent in Kennedy, because Kennedy discloses voice biometrics (see col. 2, lines 65-66) including a portion of an integrated circuit” (Office Action, page 2-3, numbered paragraph 5).

Appellants disagree. “To establish inherency, the extrinsic evidence ‘must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.’” *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999), *cited in*, MPEP 2112. A voice sensor integrated into a portion of the integrated circuit, as claimed in Claim 1, is not “necessarily present in the thing described in the reference”. On the contrary, not only is a voice sensor integrated onto the card necessarily present, it probably is not present, and probably would not work if incorporated with the device of Kennedy.

More likely, Kennedy uses a voice sensor of a radiotelephone and transmits signals obtained from that voice sensor to the smart card. Kennedy does not describe in detail the radiotelephone 101. However, Kennedy states that “U.S. Pat. No. 5,615,260

describes the construction of a radiotelephone such as that shown in FIG. 1 in greater detail” (Kennedy, Col. 2, lines 33-35). Neither disclosure explicitly or implicitly describes a voice sensor. The radiotelephone of FIG. 1 appears to be a conventional mobile telephone. Appellants posit that conventional mobile telephones have some form of microphone that is not part of an integrated circuit card inserted into the telephone. Therefore, because the biometric sensor in Kennedy may be a microphone which is *not* a portion of the smart card, it follows that “a biometric voice sensor integrated into a portion of the integrated circuit” is *not necessarily present*, as required by rule stated in Robertson, the Examiner’s inference is incorrect.

Furthermore, Kennedy describes several alternative embodiments of his invention, one of which is “the token may be comprised entirely of software … in that embodiment the hardware smart card is not required” (Kennedy, Col. 2, lines 50-52). Thus, in that embodiment it would not be possible for the biometric sensor to be incorporated into the integrated circuit card because that embodiment of Kennedy lacks a hardware smart card. However, a biometric sensor would still be required. Because that biometric sensor can, by definition, not be part of the smart card, it must be part of some other structure.

From the foregoing it is apparent that Kennedy does not include “an integrated circuit having a biometric voice sensor integrated into a portion of the integrated circuit”.

Claim 1 further recites “a voice processing circuit integrated into a portion of the integrated circuit”. On the contrary, Kennedy states that “the radiotelephone 101 includes biometric verification circuitry 201 which works in *cooperation* with the token

or smart card 105” (Kennedy, Col. 3, lines 6-8). Thus, it is clear that Kennedy’s device does not include “a voice processing circuit integrated into a portion of the integrated circuit”, but rather has voice verification circuitry in the radiotelephone rather than on the smart card.

In her Response to Amendment (Office Action, Page 8-10), the Examiner dismisses the above argument while making several misinterpretations of Kennedy. The Examiner states “Kennedy implicitly discloses a biometric voice sensor, because the feature vectors of the users voice are stored on the smart card (see col. 2, lines 55-57)” (Office Action, Page 9, Paragraph 39, Lines 3-4). While the Examiner does not state that the biometric voice sensor is on the smart card, such an inference would be required by an anticipation rejection and would not be correct. First, there is no direct mention of when the feature vectors are stored on the smart card. Smart cards are capable of storing any digital information (within size and format limitations imposed by the smart card architecture). Thus, the feature vectors could, for example, be stored at personalization of the smart card. Alternatively, because in Kennedy the smart card is inserted into a radiotelephone, the feature vectors could be stored by transfer from the radiotelephone to the smart card.

The passage of Kennedy that commences at Col. 2, lines 55-57 goes on to disclose that “[the] radiotelephone 101 circuitry will compare the spoken sound utterance with the feature vector” (Kennedy, Col. 2, Lines 61-62). Let’s consider the Examiner’s inference in the context of that statement. If the voice sensor were located on the smart card, because the radiotelephone circuitry does the comparison, the feature vectors and

the voice signals obtained from the voice sensor would have to be both transferred to the radiotelephone for performing the comparison. That is illogical. Rather, it makes more sense that the voice sensor is part of the radiotelephone and that the feature vector is extracted from the card to be used by the radiotelephone to perform the comparison.

Thus, for those reasons, the inference that the voice sensor is on the card would not be correct. Furthermore, there is no suggestion that the voice sensor is part of any integrated circuit.

The Examiner also states:

“The Applicant states that Kennedy does not disclose an integrated circuit that has a voice processing circuit. The Examiner disagrees. Lastly, when the card is inserted in the portable device and the user is prompted to [speak], a sensor is used in order to sense the users voice or speech and to perform an analysis of the users voice or speech (see col. 3, lines 6-22). Kennedy implicitly discloses an integrated circuit, because Kennedy discloses biometric verification circuitry (see col. 3, lines 6-10).” (Office Action, Page 9, Paragraph 41, Lines 2-6).

Appellants have no argument with the notion that Kennedy discloses integrated circuits. Appellants make no claim to having invented integrated circuits. Appellants have no argument with that a sensor is used to sense a users speech. However, Kennedy does not disclose that the voice sensor is integrated into an integrated circuit.

Accordingly, because, not only one, but all elements of Claim 1 are not taught by Kennedy, and certainly not “in as much detail as is contained in the claim” (MPEP 2131),

the Examiner has failed to establish a case for the proposition that Claim 1 is anticipated by Kennedy.

Claim 31 recites analogous limitations and is therefore also not anticipated by Kennedy for the same reasons given in support of Claim 1.

Claims 2-14 and 28-30 depend from Claim 1, and Claims 32-37 and 43 depend from Claim 31. These claims incorporate all the limitations of their respective base claims, recite further unique combinations, and are not anticipated for all the reasons given in support of the base claims. Accordingly, Appellants respectfully request reversal of the rejection of Claim 1-14 and 28-37, 43 and their early allowance.

2. 35 USC 103(a)

Claims 15, 27, 38 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kennedy in view of Maes et al. (6,411,933).

The Examiner has failed to establish a *prima facie* case of obviousness. “To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.” MPEP 2143. The Examiner has failed to meet this burden.

Let's consider these three criteria one-by-one: "First, there must be some suggestion or motivation ... to modify *the reference*." Claim 15 recites "The portable device of claim 2, wherein the voice sensor comprises a pressure sensor." As the Examiner has observed, "Kennedy does not disclose a pressure sensor. Maes discloses a pressure sensor." Thus the issue is whether there would be a motivation to combine the Maes pressure sensor with Kennedy's radiotelephone and smart card. The Examiner argues that "the motivation is that Maes discloses a need exists for techniques that can better guarantee that a speaker physically produced a subject utterance (see col. 2, lines 46-48 of Maes)" (Office Action, Page 6, Paragraph 30), and continuing: "a need exists for techniques that can better guarantee that a given biometric attribute has been physically produced by the person offering the biometric attribute as his own, thus Maes discloses a pressure sensor, that measures the pressure waves of the human vocal tract" (Office Action Page 7, item 32). Appellants respectfully disagree.

Kennedy's radiotelephone is a highly sophisticated instrument with the primary purpose of providing a mechanism of transmitting voice for mobile telephony. Kennedy teaches a radiotelephone that is more secure than ordinary radiotelephones. Kennedy's radiotelephone requires that "the user must insert a PIN and utter sounds. The radiotelephone device will activate the secure functions only if the PIN is correct and the sounds uttered are authenticated against voice feature vectors stores it (sic) the token" (Kennedy, Abstract). Thus, it appears that Kennedy has attempted to increase the level of authentication to a three-factor authentication (what you have, what you know, and who you are), wherein the "what you know" is answered by the user entering a PIN and the "who you are" is answered by "sounds uttered authenticated against voice feature

vectors". There is nothing in Kennedy that indicates that there is a perceived inadequacy in the biometric that is used therein. Therefore, a person would not be motivated to modify Kennedy to find better biometric solutions.

Now consider the motivation to combine from the perspective of Maes. Maes deals with mechanisms used by a human to produce speech (Maes, Col 8, lines 38-41, line 45 and line 50). Maes teaches that "the pressure pulses cause the surrounding tissue to vibrate at low levels which affects the sound as well. ... Such vibrations can be measured in accordance with the sensor 110" (Maes, Col. 8, Lines 50-58). Maes further explains that "it is to be appreciated that the antenna 23 corresponds to the speech production feature capturing sensor 110 of Fig. 1" (Maes, Col. 9, Lines 45-47). "The antennas 21, 22, 23 ... are directed to various parts of the vocal system" (Maes, Col. 9, Lines 25-26). "Antenna 23 is position (sic) to detect vocal fold motion or glottal excitation" (Maes, Col. 9, lines 35-36), which is illustrated in Fig. 6 of Maes as being proximate to the lower part of the user's neck.

Maes further teaches an elaborate positioning structure comprising "support stand 25 positions the antennas 21,22,23 to detect signal from various parts of the vocal tract, e.g., by using face positioning structure 29 and chest positioning structure 30" (Maes, Col. 9, lines 29-32). Thus, the inference must be drawn that it is critical for proper functioning of Maes apparatus that it would be properly positioned. A person skilled in the art would therefore rule out its use in conjunction with a mobile telephone, which by its very nature is more frequently not positioned in a particular position with respect to a

user's vocal tract. On the contrary, mobile telephones typically are constructed such that they do not need to be held directly in front of the user's mouth or vocal apparatus.

Therefore, a person would not be motivated to modify Maes to adopt the teachings of Kennedy.

"If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." MPEP 2143.01 *quoting* In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Adding the necessary equipment to Kennedy to provide for a pressure sensor to detect speech would necessarily be considered "unsatisfactory" for most any person finding himself using the Kennedy invention modified to incorporate the speech production feature-capturing sensor of Maes. Appellants invite the Board to consider a mental picture of such an apparatus. It would have the radiotelephone of Kennedy with an antenna (See, Maes, Fig. 6) that would be positioned immediately next to the user's lower neck. Appellants submit that such an apparatus would not be practical and would be considered utterly unsatisfactory for its intended purpose as a radiotelephone. Would the members of the Board consider carrying such an apparatus in lieu of a conventional mobile telephone? Accordingly, because the reference would be considered unsatisfactory for its intended purpose, there would be no suggestion or motivation to make the proposed modification.

"If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the

references are not sufficient to render the claims *prima facie* obvious" MPEP 2143, quoting, In re Ratti, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). The modification to Kennedy to add a speech production feature capturing sensor 110 of Maes would change the principle of operation of Kennedy. The speech production feature capturing sensor of Maes is used to detect "pressure pulses [that] cause the surrounding tissue to vibrate at low levels ... [that are] not heard acoustically" (Maes, Col. 8, lines 50-56). Kennedy's apparatus is focused on improvements to a radiotelephone. Radiotelephones are used to communicate that which *can be* acoustically heard. Thus, the use of a speech production feature capturing sensor to detect something that cannot be heard would change the principle of operation of Kennedy.

Thus, with respect to the first criteria set forth in the MPEP Section 2143, the issue whether there is some suggestion or motivation to combine Kennedy and Maes, has not been found.

The second requirement for a *prima facie* case of obviousness is that there must be a reasonable expectation of success. MPEP 2143. The proposed modification to Kennedy could not reasonably be expected to succeed. Kennedy teaches certain techniques associated with voice sensor, a biometric voice sensor as used in a radio telephone to solve the problems associated with the activation of secure function. Maes teaches certain technique associated with pressure sensor to solve the problems associated with measuring the pressure waves of the human vocal tract. As noted above, Maes disclosure implies the requirement that the speech production feature capturing sensor (which corresponds to the sensor 110 for detection of pressure waves) is

positioned very precisely proximate to the front of the user's lower neck. With the expected use of a cell phone handset, that could not be expected. Thus, it would not be reasonable to expect to succeed in producing the proffered combination of Kennedy and Maes.

Finally, the prior art references must teach or suggest all the limitations of the claimed invention. As the Examiner has noted "Kennedy does not disclose a pressure sensor" (Office Action, Page 6, Paragraph 30). As noted above in the argument in response to the rejection under 35 USC 102, Kennedy does not teach or suggest "an integrated circuit having a biometric voice sensor integrated into a portion of the integrated circuit, wherein the voice sensor is configured to detect the speech of a user and to produce a signal responsive to the speech of the user; and a voice processing circuit integrated into a portion of the integrated circuit, wherein the voice processing circuit is configured to receive the signal from the biometric voice sensor and to process the signal to extract the signal characteristics" (Claim 1). While Maes may teach a form of a pressure sensor, at a minimum, Maes also fails to teach or suggest "a biometric voice sensor integrated into a portion of the integrated circuit". As discussed hereinabove, Maes' sensor 110, which is used to detect pressure waves generated from speech production, is an antenna (23) that projects towards the user's lower neck. This clearly cannot be construed as a biometric sensor that is "integrated into a portion of the integrated circuit".

Accordingly, for any of the foregoing reasons the Examiner has failed to meet the third criteria for establishing a *prima facie* case for the assertion that Claims 15, etc. are obvious over Kennedy in view of Maes.

To establish a *prima facie* case of obviousness, three basic criteria must be met: motivation to combine, expectation of success, and teaching of all elements. The Examiner has failed to meet each of these criteria. Accordingly, because a *prima facie* case of obviousness has not been met if even just one of the three criteria have not been satisfied, the Examiner has failed to establish a *prima facie* case of obviousness for the proposition that Claim 15 is obvious over Kennedy in view of Maes. “If examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of the patent.” In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992), *quoted in* In re Lowry, 32 F.3d 1579, 32 USPQ2d 1031 (Fed. Cir. 1994).

In her Response to Amendments, the Examiner asserts that the motivation to combine these references is that Maes discloses a need exists for techniques that can better guarantee that a speaker physically produced a subject utterance, a need exists for techniques that can better guarantee that a given biometric attribute has been physically produced by the person offering the biometric attribute as his own. (Office Action, Page 10, Paragraph 42). While the Appellants agree that such are laudable goals, those goals do not negate the issues of modifying a reference to change the principle of operation, rendering the reference unsatisfactory for its intended purpose, the lack of likelihood of success, or that both references fail to teach or suggest at least one element of the Claim.

Therefore, Appellants respectfully submit that Claim 1 is not obvious over the combination of Kennedy and Maes, taken singly or in combination. Claim 31 recites analogous limitations to those set forth in Claim 1 and is, therefore, also not obvious for the same reasons given in support of Claim 1.

Claims 15 and 27 depend from Claim 1 and Claims 38 and 44, from Claim 31. These claims incorporate all the limitations of their respective base claims and provide further unique and non-obvious combinations. Therefore, Claims 15, 27, 38 and 44 are patentable over Kennedy and Maes, at least for the reasons given in support of Claims 1 and 31, and also by virtue of such further combinations.

Conclusion of Argument

Appellants have argued hereinabove that the rejections under 35 USC 102(b) and 35 USC 103(a) are improper and that the claims are patentable over the prior art. Accordingly, Appellants respectfully request reversal of the rejections of Claims 1-15, 27-38, 43, and 44 and their early allowance.

Respectfully Submitted,

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8. Claims appendix

Amendments to the claims:

1. An integrated circuit card, comprising:

an integrated circuit having a biometric voice sensor integrated into a portion of the integrated circuit, wherein the voice sensor is configured to detect the speech of a user and to produce a signal responsive to the speech of the user; and

a voice processing circuit integrated into a portion of the integrated circuit, wherein the voice processing circuit is configured to receive the signal from the biometric voice sensor and to process the signal to extract the signal characteristics.

2. The integrated circuit card of claim 1, wherein the integrated circuit further includes memory for storing information indicative of at least one user's voice characteristics.

3. The integrated circuit card of claim 2, further comprising means for establishing a data link to download data from which the stored information is derived.

4. The integrated circuit card of claim 2, wherein the integrated circuit card uses the stored information to authenticate the user.

5. The integrated circuit card of claim 4, wherein the information is indicative of the voice characteristics of multiple users and wherein the integrated circuit card is configured to authenticate each of the multiple users.

6. The integrated circuit card of claim 5, wherein the integrated circuit card contains user specific profile information for each of the multiple users that enables user specific device functionality.
7. The integrated circuit card of claim 4, wherein the integrated circuit is configured to authenticate a user of the integrated circuit card by comparing the characteristics of the voice sensor signal to information stored in memory indicative of a predetermined password.
8. The integrated circuit card of claim 7, wherein the information stored in the memory is indicative of a user speaking a password and the integrated circuit is configured to authenticate a user by comparing the characteristics of the voice sensor signal to the information stored thereby determining whether the user is speaking the password.
9. The integrated circuit card of claim 2, wherein the stored information to identify the user.
10. The integrated circuit card of claim 2, wherein the integrated circuit is configured to execute a voice-transmitted command by comparing the characteristics of the voice sensor signal to information stored in the memory indicative of an user speaking the command.
11. The integrated circuit card of claim 2, wherein the integrated circuit is further configured to encrypt the voice sensor signal using an algorithm.
12. The integrated circuit card of claim 2, wherein the integrated circuit is configured to recognize the content of the user's speech.
13. The integrated circuit card of claim 12, wherein the recognized content is used to classify the speech by keywords.

14. The integrated circuit card of claim 2, wherein the integrated circuit card comprises a plastic frame in which the integrated circuit is embedded and wherein the plastic frame is compliant with ISO 7816.
15. The integrated circuit card of claim 2, wherein the voice sensor comprises a pressure sensor.
16. The integrated circuit card of claim 15, wherein the pressure sensor includes a membrane that responds to a voice pressure wave.
17. The integrated circuit card of claim 15 16, wherein the pressure sensor comprises a set of piezoelectric gauges arranged in proximity to the membrane portion and configured to detect resistivity changes induced by the voice pressure waves.
18. The integrated circuit card of claim 17, wherein the gauges are connected in a Wheatstone bridge configuration.
19. The integrated circuit card of claim 15, wherein the pressure sensor comprises a first ring oscillator comprising an odd number of CMOS inverters and configured such that its output frequency increases when the pressure increases.
20. The integrated circuit card of claim 19, wherein the pressure sensor comprises a second ring oscillator comprising an odd number of CMOS inverter and configured such that its output frequency decreases when the pressure increases.
21. The integrated circuit card of claim 20, wherein the ratio of the first ring oscillator frequency and the second ring oscillator frequency is used to minimize temperature effects and optimize pressure sensitivity.

22. The integrated circuit card of claim 15, wherein the pressure sensor comprises a first capacitor and second capacitor.
23. The integrated circuit card of claim 22, wherein the capacitance of the first capacitor varies responsive to voice pressure waves and the capacitance of the second capacitor remains substantially constant responsive to voice pressure waves.
24. The integrated circuit card of claim 22, wherein first capacitor and second capacitor are connected in a half bridge configuration and connected to a signal processing unit configured to produce a voltage signal indicative of the change in capacitance of first capacitor.
25. The integrated circuit card of claim 15, further comprising a compound in contact with the active layer wherein the compound transfers voice pressure waves to the sensitivity element of the pressure sensor.
26. The integrated circuit card of claim 25, wherein the compound comprises room temperature vulcanized silicon.
27. The integrated circuit card of claim 1, further comprising a communication interface unit comprising a portion of the integrated circuit and connected to the voice processing circuit, wherein the interface unit includes a serial interface for communicating information through contacts according to at least one of an ISO and USB protocol.
28. The integrated circuit card of claim 1, further comprising a battery power source to power The device integrated circuit card.
29. The integrated circuit card of claim 1, further comprising a wireless port configured to receive an electromagnetic signal to power The device integrated circuit card.

30. The integrated circuit card of claim 1, wherein the communication interface unit further includes a wireless port for communicating information to and from The device integrated circuit card in contactless applications.

31. A method of processing voice waves with an integrated circuit card, comprising:

generating an electrical signal with a voice sensor of the integrated circuit card responsive to speech spoken into the voice sensor;

analyzing the electrical signal with a signal processing circuit of the integrated circuit card to detect characteristics of the voice; and

comparing the detected voice characteristics with information stored in a memory of the integrated circuit card and indicative of a user's voice.

32. The method of claim 31, further comprising, responsive to the comparison between the detected voice characteristics and the information indicative of the user's voice, identifying the user.

33. The method of claim 31, further comprising, responsive to the comparison between the detected voice characteristics and the information indicative of the user's voice, authenticating the user.

34. The method of claim 33, wherein authenticating the user includes comparing the characteristics of the voice sensor signal to information stored in the memory indicative of the user speaking a password.

35. The method of claim 31, further comprising executing a voice-transmitted command.

37. The method of claim 31, further comprising recognizing the content of the user's speech.
38. The method of claim 31, wherein generating the electrical signal includes measuring variations in an electrical parameter caused by the voice pressure wave modifying an electrical characteristic of a pressure sensor of the integrated circuit.
39. The method of claim 38, wherein generating the electrical signal comprises using a first electrical parameter that increases with the voice pressure wave and a second electrical parameter that decrease or remains constant with the pressure wave and comparing the first and second parameters to determine the magnitude of the pressure wave.
40. The method of claim 39, wherein the first and second electrical signals comprise the voltage across first and second piezo resistors respectively.
41. The method of claim 39, wherein the first and second electrical signals are the capacitance of a first capacitor and the capacitance of a second capacitor respectively.
42. The method of claim 39, wherein the first and second electrical signals are the frequencies of first and second ring oscillators respectively.
43. The method of claim 31, further comprising, responsive to the comparison between the detected voice characteristics and the stored information, enabling communication between the integrated circuit card and the external data processing system.
44. The method of claim 43, wherein communication between the processing system and the smart card is done via at least one of an ISO port, a USB port, and a wireless port.

45. The method of claim 16, wherein the membrane is micro-machined into the integrated circuit.
46. The method of claim 16 wherein the membrane has a thickness in the range of 10.0 to 25.0 micrometers.
47. The method of claim 15 wherein the pressure sensor comprising a set of pressure transducer.
48. The method of claim 47 wherein the pressure transducer is a piezoelectric gauge comprising of polysilicon resistors in the vicinity of the membrane.

9. Evidence appendix

Not applicable.

10. Related proceedings appendix

Not applicable.